"TEACHING AND TESTING PRACTICAL SKILLS IN CHEMISTRY'

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DEDICATION

To those who inspired and encouraged me to complete this work.

PREFACE

This thesis is original and the whole work described here was carried out by me. References are given wherever the results of others have been used. No part of the thesis has been submitted for a degree or other qualification at this or any other University.

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SUMMARY

This research work deals with the assessment of certain manipulative skills in school science practical work. The results were used to study the reliability and validity of assessment, , and also to investigate the effect of teaching on pupils' ability to retain the knowledge and reproduce the taught skills and even to extend the taught skills to a similar new situation. The work was carried out in 3 stages.

In the first stage two skills were assessed, viz (1) measurement of volume by measuring cylinder, and (2) pouring out the liquid, involved in the reaction of Mg ribbon with dil. HCl. Approximately 75 fourth-form pupils (14-15 years old), divided into 3 sets, carried out the experiments in three successive sessions. In each session 9 judges, divided into 3 panels, carried out the assessment, in the laboratory, of pupils' ability to perform the techniques involves in the experiment (referred to as Method -T). Judges in each of 2 panels assessed one of the two skills while those in the third panel assessed both the skills for each pupil in the set. Arrangement was such that at the end of 3 sessions, each panel of judges assessed both the skills simultaneously in one session and individually in 2 sessions. The final result, i.e. time for Mg to dissolve completely, recorded and reported by each pupil, was checked against a standard result to carry out an asssessment based on the final outcome (product) of the extended task involving the skill (referred to as Method -P).

Both the plot of data and calculation of Pearson-r indicate that no significant correlation exists between the achievement of pupils, obtained from two methods of assessment, for carrying out either of the skills in

any of the three sessions. These two aspects, (i) comparison of pupils' achievement based on the two methods of assessment, and (ii) calculation of Pearson -r, have been considered as the measures for validity of assessment.

To study the reliability of assessment, two criteria were considered:- (1) Comparison between the assessment of either of the skills by a panel of judges engaged in assessing only one skill with that by another panel engaged in assessing both the skills simultaneously, and (2) total number of agreements/disagreements among the 3 judges in each panel for assessing a skill.

Results show that the mean value of achievement for carrying out a skill remains more or less similar, irrespective of the change in the mode of assessment. The mean value of achievement for the pouring out skill is much higher than the volume measurement skill. Poor performance (~ 33% marks) for the volume measurement skill may be the reason for low achievement of pupils assessed by Method -P.

Agreement among the judges is almost 100% for assessment of the pouring out skill, while it is about 50% for the volume measurement skill. Furthermore it remains unaffected whether the judges assessed one skill alone or 2 skills at the same time.

Results of 2X3 ANOVA indicate that the variable, such as the methods of assessment, the number of panels of judges, and number of assessment sessions have no significant effect on the number of agreements/disagreements among the judges assessing each of the skills.

The second stage of the research concerns the studies on pupils' ability to retain and reproduce process skills taught earlier. All the pupils who took part in the first stage of the research were also used as samples here. Pupils in each of the 3 sets were randomly divided into 3 groups:

(1) Volume measurement group, who were taught the skill of measuring volume using a measuring cylinder,

(2) Heating group, who were taught the skill of heating a solid sample using a Bunsen burner, and

(3) Control group, who were shown a video film involving none of the skills mentioned earlier.

Following the summer holidays, giving a 2 months break, a test session was organised. All the pupils carried out 2 experiments, one involving the volume measurement skill and the other using the heating skill. Following a check-list, 8 science teachers assessed the pupils' manipulative skills (assessment by Method -T).

The results show that in the volume measurement experiment the taught group is twice as efficient as the untaught groups, but in the heating experiment the taught group is only slightly better than the untaught groups.

Analysis of variance (3X3 ANOVA) shows that the results of the assessment are influenced by the variables (method gr. and session) at $p < 0.001$ level for the volume measurement skill and also 2 skills (position of the test-tube holder and angle of the test tube) out of a total of 4 skills involved in the heating of solids experiment.

In the 3rd and final stage of the investigation, studies have been made on pupils' ability to transfer a skill which has been taught some time earlier, to a new situation. 2 sets of 3rd form (13-14 years old) pupils from a local independent school took part in this study. For the teaching session, each set was randomly divided into 3 groups:

(1) A Volume group who were taught volume measurement using a measuring cylinder,

(2) A Heating group who were taught heating solids using a Bunsen burner, and

(3) A Control group watched a video film involving neither of these skills.

In a test session, after a further break of 6 weeks, all the pupils were asked to carry out 2 experiments which involved 2 skills, viz: (1) Volume measurement using a burette, and (2) heating liquid using a Bunsen burner. Assessment was carried out (by Method -T), following a check-list, by 4 science teachers. The density data, reported as the results of the volume measurement experiment, formed the basis for the assesment by Method -P, of pupils' performance of manipulative skill.

Results of assessments by both the methods show that the taught group have performed better in both the experiments. Calculation of Pearson-r values indicates that there is no significant correlation between the pupils' achievement data obtained from these two methods of assessment. Validity of assessment carried out in this way has also been discussed. Studies of 3X2 ANOVA suggest that the variables such as method groups or sessions have no influence on pupils' achievement.

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